Niagara Escarpment Greenway Study

Fond du Lac County, Wisconsin

DRAFT June 2020

NIAGARA ESCARPMENT RESOURCE NETWORK

Prepared by the Niagara Escarpment Resource Network with the assistance of the East Central Wisconsin Regional Planning Commission

Niagara Escarpment Greenway Study

Fond du Lac County, WI

June 2020

Prepared by the
Niagara Escarpment Resource Network
with the assistance of the
East Central Wisconsin Regional Planning Commission

A proud program of the Lakeshore Natural Resource Partnership www.lnrp.org

ABSTRACT

TITLE: Niagara Escarpment Greenway Study, Fond du Lac County

AUTHORS: Eric W. Fowle, AICP – Niagara Escarpment Resource Network
Adam Pfefferle – East Central WI Regional Planning Commission

SUBJECT: Niagara Escarpment Conservation Planning

DATE: June 2020

TABLE OF CONTENTS

FIGURES

TABLES

MAPS

APPENDICES

CHAPTER 1: INTRODUCTION

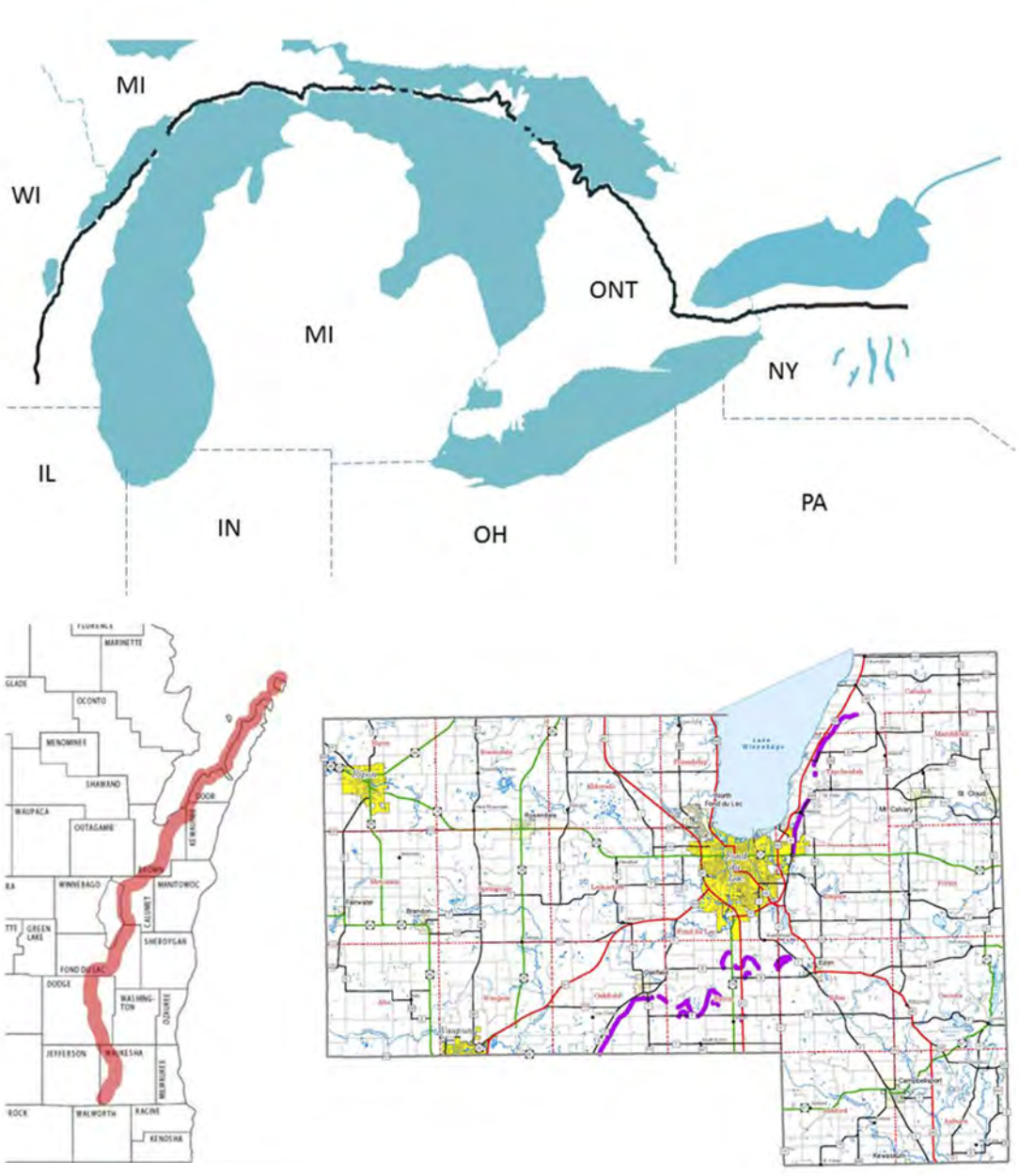
BACKGROUND

In 2018, discussions regarding the importance of protecting the Niagara Escarpment occurred with vigor amongst Fond du Lac County and community leaders based on an up-swelling of continued citizen concerns. The Niagara Escarpment in Fond du Lac County is well documented as a globally unique geologic and ecologic corridor comprised of varied and diverse resources, some which may lie at some distance from the Escarpment's cliff face brow or base.

As such, Fond du Lac County envisions the creation of a *Niagara Escarpment Greenway* in the future. Essentially, a well-connected - yet often interrupted - functionally protected greenspace corridor along its portion of the Niagara Escarpment geologic formation. (See Chapter 4 for more on Greenways).

The County fostered several meetings with concerned citizens and town leaders from across the corridor and in 2019 elected to budget a small amount of funds to contract with the East Central Wisconsin Regional Planning Commission to prepare a study which would provide an objective view of the Escarpment's resources and their relationship to land ownership patterns across the Study Area Figure 1-1). The Study Area focuses on the 36 mile long cliff-face corridor and includes the ten communities of: Towns of Calumet, Taycheedah, Fond du Lac, Empire, Eden, Byron and Oakfield; the Villages of Eden and Oakfield, and; the City of Fond du Lac.

Figure 1-1: Niagara Escarpment Corridor Location



IMPORTANCE OF THE NIAGARA ESCARPMENT

The Niagara Escarpment in Wisconsin (including Fond du Lac County) is well documented as a globally unique geologic and ecologic feature. The environmental reasons for protecting the Niagara Escarpment are many and include but are not limited to

- Globally unique geology and geologic sites and features;
- Unique ecology (rare habitats, threatened and endangered plants and animals), and;
- Groundwater protection due to the karst environment.

Culturally, the Niagara Escarpment corridor has numerous archeologic and historic sites as the landscape was well revered and utilized by native populations and early settlers. Protection of these sites and the broader cultural landscape can assist with:

- Ensuring that important viewsheds, vistas and the overall "sense of place" of the Niagara Escarpment Greenway is preserved for future generations;
- Reinforcing and protecting a large piece of Fond du Lac County's overall identity and attractiveness as a County;
- Increasing public ownership and public access (primarily bike and pedestrian) to non-sensitive areas along this corridor so as to heighten citizens' and visitors' appreciation for the Niagara Escarpment.

Indirectly, protection of the Niagara Escarpment Corridor can have other beneficial side-effects. Studies across the country have documented the value of nature's "services" as compared to the hard costs of infrastructure, as well as the increase in property values for lands adjacent to protected areas. Other broad impacts of preservation must also be considered. Such as:

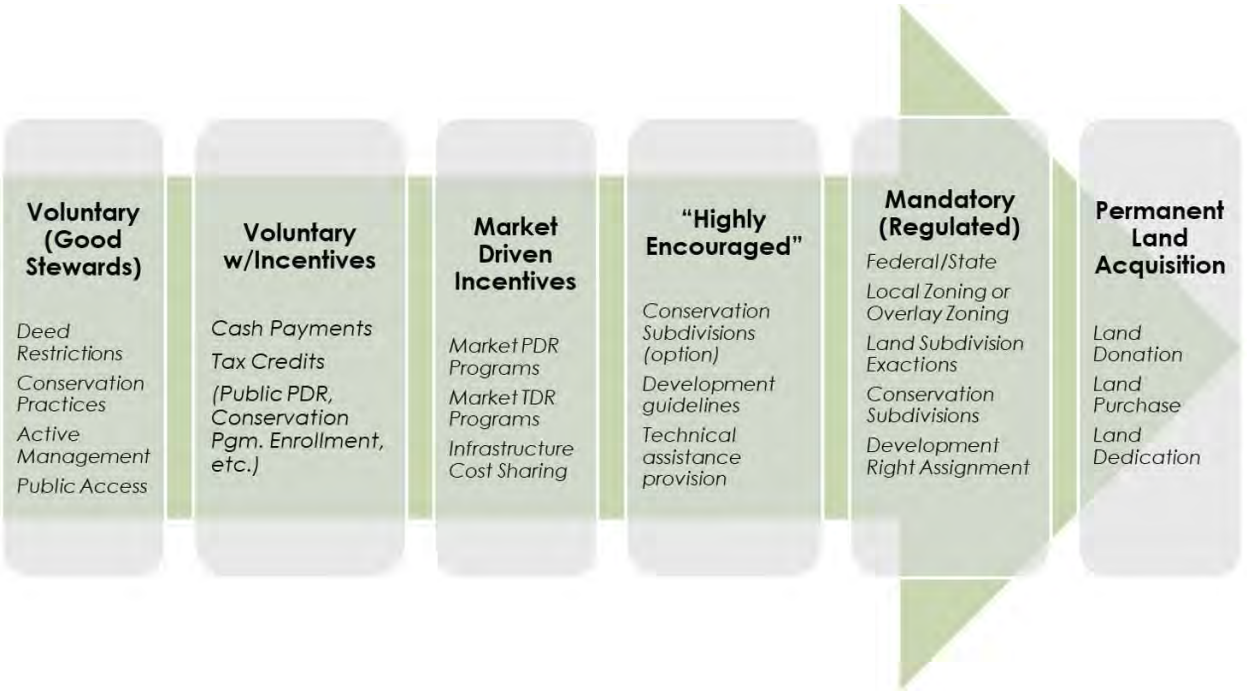
- Positive Health Impacts – Aside from drinking water protection, the Niagara Escarpment Greenway could provide for more healthy living opportunities (access to nature, hiking, biking, etc.);
- Talent Retention & Attraction – A major issue for the County, new workers need to be retained or attracted to fill the jobs of existing business and industry. Providing for, and promoting, a natural amenity such as the Niagara Escarpment Greenway could be 'the hook' to attracting youthful talent to the region and ensuring a strong local economy, and;
- Geotourism Opportunities – Different than regular tourism, geotourism better connects the landscape and recreational activities with like-minded businesses and travelers that support conservation, further diversifying and bolstering the local economy. This includes ever growing opportunities in the agri-tourism sector.

More information about the Niagara Escarpment can be found in Appendix A.

STUDY OVERVIEW & GOALS

"Land Protection" can mean many things. As shown in Figure 1-2, actions or activities lie along a spectrum which ranges on one end with; "the voluntary conservation of a property's natural resources"; to "management, regulation, and incentives" in the middle; and "public/non-profit ownership or control" on the far end.

Figure 1-2: Spectrum of Land Conservation Options



Ultimately, the number and type of activities which are available or implemented for escarpment protection in Fond du Lac County is highly dependent on the existence of private landowners and their willingness to participate. With these conditions in mind, the following questions were raised, and to a great degree, answered in this report:

1. *How does a community or the county know and understand the relationship between the escarpment's natural resource base and individual (or collective) property ownership patterns?*
2. *Which private parcels of land along the escarpment corridor offer the most opportunity – or the most impact – for implementing existing or new land/water conservation and protection programs?*
3. *How can the escarpment's natural resources, combined with existing development patterns, be best prioritized and targeted for protection?*

4. *How can Fond du Lac County and its communities use this information to consistently apply development standards along the Niagara Escarpment corridor which foster conservation, and where should they apply?*

This study is primarily an "inventory" project with additional supporting analyses being provided using Geographic Information Systems (GIS) as well as research on technical definitions associated with the Niagara Escarpment. These important and time-consuming tasks are necessary so that a common understanding can be had of the Escarpment's individual resource components and their geographic relationships and patterns.

The overall goals of this project were established as follows and were applied to a study area consisting of ten communities (towns, villages, and cities) as shown in Figure 1-3:

1) Inventory, identify, and source all known geologic, environmental, and cultural GIS data sets from a variety of sources which may provide insights on the various features of the Niagara Escarpment corridor within Fond du Lac County.

2) Generate a series of Greenway Analysis maps (to the parcel level) which assess the Niagara Escarpment corridor by prioritizing the functional aspects of its resource components.

3) Using this information, determine a series of potential definitions for the Niagara Escarpment in Fond du Lac County which considers the broader for which to utilize when considering different management and conservation techniques,

4) Based on the selected definition and Greenway Map, develop an objective "vulnerability index" for lands corridor with respect to current levels of planning, regulation and development plans and patterns.

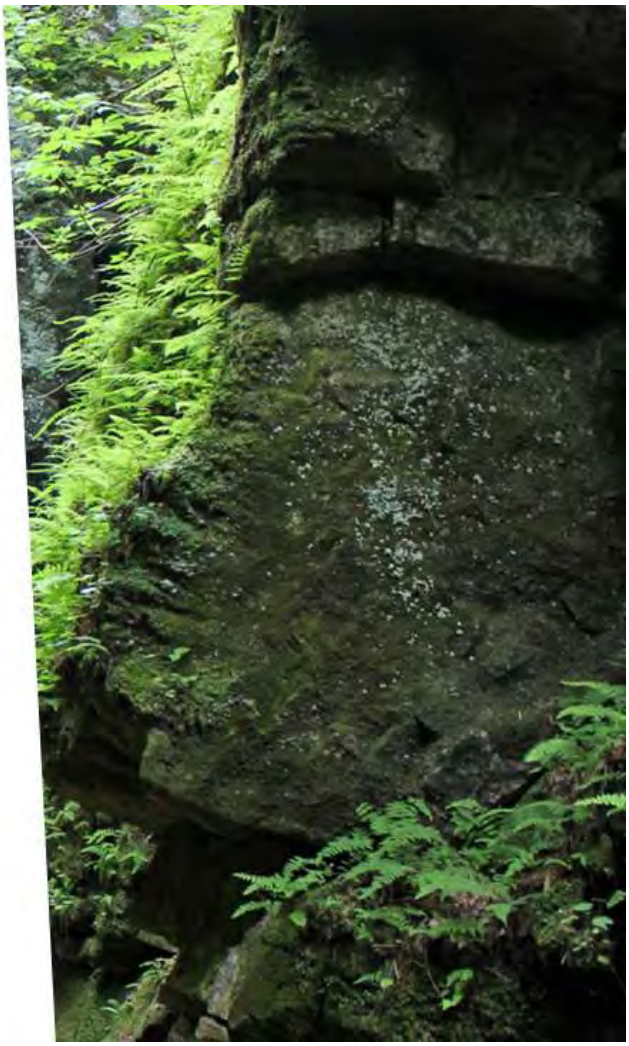
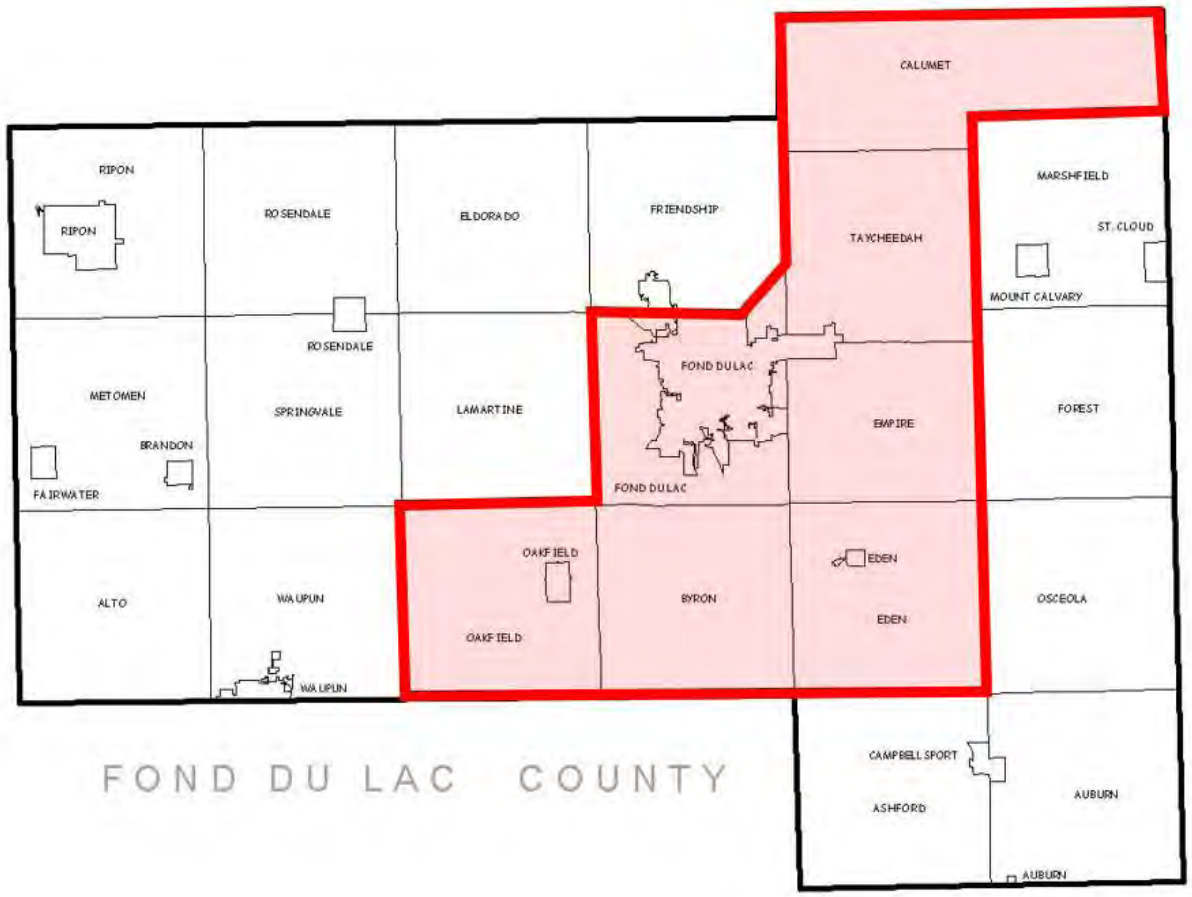


Figure 1-3: Study Area Location



CHAPTER 2: RESOURCE INVENTORY & GIS DATA COMPILATION

BACKGROUND

To address the goals and questions contained in the Introduction, this project started with a thorough review of known sources that possessed GIS data related to the Niagara Escarpment which could be of use in this effort. Various sources were consulted and inventoried, including:

- ECWRPC current and historical data archives;
- Fond du Lac County GIS data sets;
- State of Wisconsin agency data, including WDNR, WGNHS, WSHS and DATCP;
- Federal agency data sources including EPA, USF&W, NPS and NRCS;
- Non-profit organizations.

Existing plans, zoning ordinances and related documents at the county and community level within the Study Area were also inventoried and reviewed for potential data and information which could also be incorporated into the Greenway Study.

GIS DATA IVENTORY

As a result of this research, a total of 201 individual layers of GIS data were identified associated with base map information, land use, zoning, infrastructure, and natural/cultural resources. Of the 201 identified layers, 181 of them were obtained, processed, and used in some manner in this report.

As illustrated in Figure 2-1 and as contained in Appendix B, a series of tables list the GIS data collected, along with an indication of whether the data was used in the greenway analysis (Chapter 3) or is purely informational.

Figure 2-1: Sample Table from GIS Inventory

Data ID	Data Obtained	Used/Not Used in Greenway Analysis	Feature Class	Feature Type	Data Format	Resource Importance Ranking (1 low - 5 high)
113	✓	USED	AGRICULTURE	Soils - Prime Ag Lands	POLY	4
114	✓	USED	AGRICULTURE	Existing Vineyards / Grape Growing	POINT/POLY	5
115	✓	USED	PUBLIC LANDS	Federal Land	POLY	5
116	✓	USED	PUBLIC LANDS	WDNR Managed Properties	POLY	5
117	✓	USED	PUBLIC LANDS	Other State Owned Lands	POLY	5
118	✓	USED	PUBLIC LANDS	County Owned Lands	POLY	5
119	✓	USED	PUBLIC LANDS	Municipal Owned Lands	POLY	5
120	N/A		CONSERVATION	Conservation Reserve Program Lands	POLY	N/A
121	N/A		CONSERVATION	Land Trust Conservation Easements	POLY	N/A

Overall, nineteen (19) "Resource Themes" were created as the GIS layers were organized and placed into common categories for subsequent individual and collective spatial analysis. The nineteen generalized themes contained in this collection of data are as follows:

1. **Background Imagery:** Includes various years of aerial photography and or digital elevation models for use as background graphics on various maps.

2. **Basemap Information:** Includes various point, line, polygon, and annotation (text) layers for parcel boundaries, building footprints, street centerlines, public land survey system (PLSS), reference feature locations, rights-of-way, and place names.

3. **Map Boundaries:** Includes various political, tax, and legal boundaries for features such as municipalities, sanitary districts, school districts, and growth area agreements.

4. **Bedrock Geology:** Information pertaining to the bedrock geology and glacial (quaternary) geologic conditions including soils, mining, and landscape feature types.

5. **Glacial Geology:** Information pertaining to the bedrock geology and glacial (quaternary) geologic conditions including soils, mining, and landscape feature types.

6. **Groundwater:** Information from a variety of sources helps to portray characteristics and qualities of the local and regional groundwater systems within the Study Area. Broad and fine scale information regarding contamination susceptibility, recharge rates, water levels, and flow boundaries is contained here.

7. **Surface Water:** Water features (rivers, streams, lakes) and water-related geographic data such as wetlands, floodplains, watersheds, and water body quality information are contained in this category.

8. **Ecology:** This category includes layers of information that relate to the study of how organisms interact with one another and with their physical environment. Broad, landscape level information pertaining to land type associations, natural communities, eco-regions, historic vegetative cover, and natural heritage inventories are included here.

9. **Wildlife:** This category contains point and polygon information for a variety of resources and factors pertaining to wildlife, habitat, flora, and fauna. It includes such things as woodlands, stream designations, native vegetation, endangered/threatened species, and areas with special designations.

10. **Conservation:** Information pertaining to lands that are currently, or in perpetuity, managed for natural, environmental, or heritage conservation purposes. Public lands are NOT included in this category.

11. **Agriculture:** Various information pertaining to the use, ownership, designation, or quality of farmlands within the Study Area. Items such as soils characteristics, program designations, land use and zoning are contained in this category.

12. **Cultural/Historic:** Point and polygon features which delineate or identify important historic, cultural, and natural heritage site as a variety of scales, from landscape-level to site specific. Some information in this category was obtained through this inventory but is not available for public viewing or use due to its sensitivity.

13. **Public Lands:** This category generally contains information on parcels of land under public ownership for a variety of uses. It consists of an overlay of all federal, state, county, and municipally owned and state-owned properties (other than those in the recreation category).

14. **Recreation:** A variety of layers depicting publicly accessible active and passive recreation areas.

15. **Trails:** The category includes a variety of line work related to existing, planned and proposed public and private trails within the Study Area. Trails owned or managed by State, County, local government, and non-profit organizations are included here.

16. **Scenic Resources:** Information pertaining to identified vistas and viewsheds, scenic landscapes, scenic easements and rustic roads are all part of this category.

17. **Infrastructure:** This category includes GIS layers for large scale infrastructure which may be important from a conservation or land use siting perspective includes: Wind farms/towers, schools, powerline corridors and municipal wells for example.

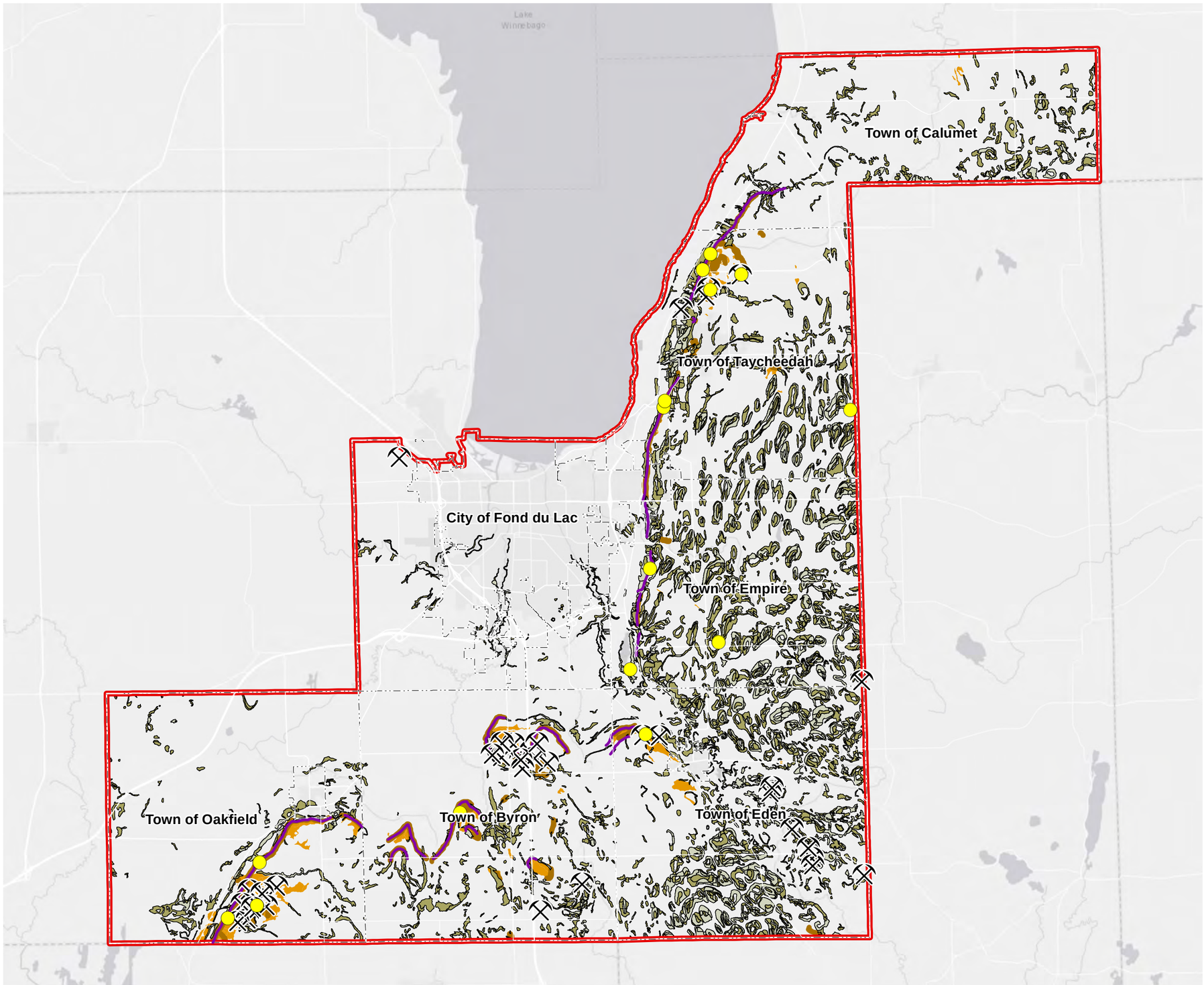
18. **Land Use:** This category includes existing and proposed land use information for all communities within the Study Area. Existing land use is available from the following time-periods: 2000, 2005 and 2015. Proposed (or Future) Land Use is obtained from the various communities' individual Comprehensive Plans and generally project to the year 2030 or 2040.

19. **Zoning:** This category includes the current zoning map boundaries and descriptions for all communities within the Study Area.

Seven of these Resource Themes were used in the primary Greenway Analysis (Chapter 3) and are illustrated for the Study Area in Maps 2-1 through 2-7:

1. Bedrock Geology Resources
2. Glacial Geology Resources
3. Groundwater Resources
4. Surface Water Resources
5. Ecological Resources
6. Agricultural Resources
7. Historic & Cultural Resources (used for reference purposes only)

Map 2-1
Bedrock Geology Resources



- Geological Feature
- Mining Site
- Escarpment Outcrops
- Soil Slope 6 - 12%
- Soil Slope >12%
- Rock Land Soils
- Depth to Bedrock < 5 Feet
- MCD Boundary
- Niagara Escarpment Corridor

Source: Escarpment Outcrop digitized by BLRPC, based on field data by J. Kluessendorf & D. Mikulic, 2000.
Soil data by NRCS, Mines by ECWRPC.
Geological features collected at public information meetings 2011.

N
W E
S

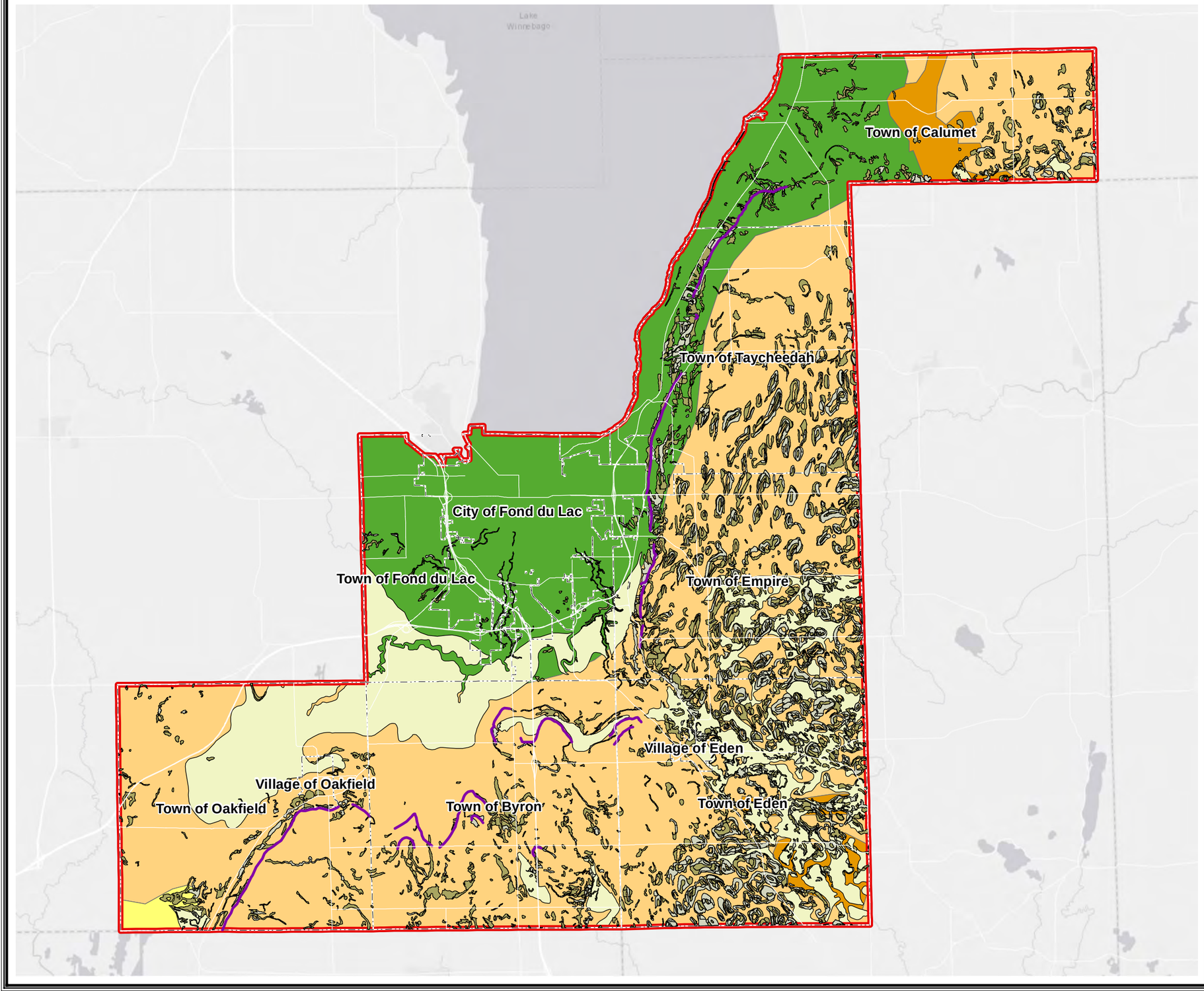
0 1 2 4
Scale in Miles

PREPARED MAY 2020 BY:

East Central Wisconsin Regional Planning Commission
ECWRPC

D:\ECWGIS\2442_FDLescarpment\Map2-1BedrockGeologyResources.mxd

Map 2-2
Glacial Geology Resources



Escarpment Outcrops

Soil Slope 6 - 12%

Soil Slope >12%

Quaternary Geology - Glacial Deposits

Surficial Deposit

Sand and Gravel

Sand

Peat

Clay

MCD Boundary

Niagara Escarpment Corridor

Source:
Glacial deposit data from Wisconsin Geological & Natural History Survey.
Soil data from USDA Natural Resources Conservation Service.

N
W E
S

0 1 2 4

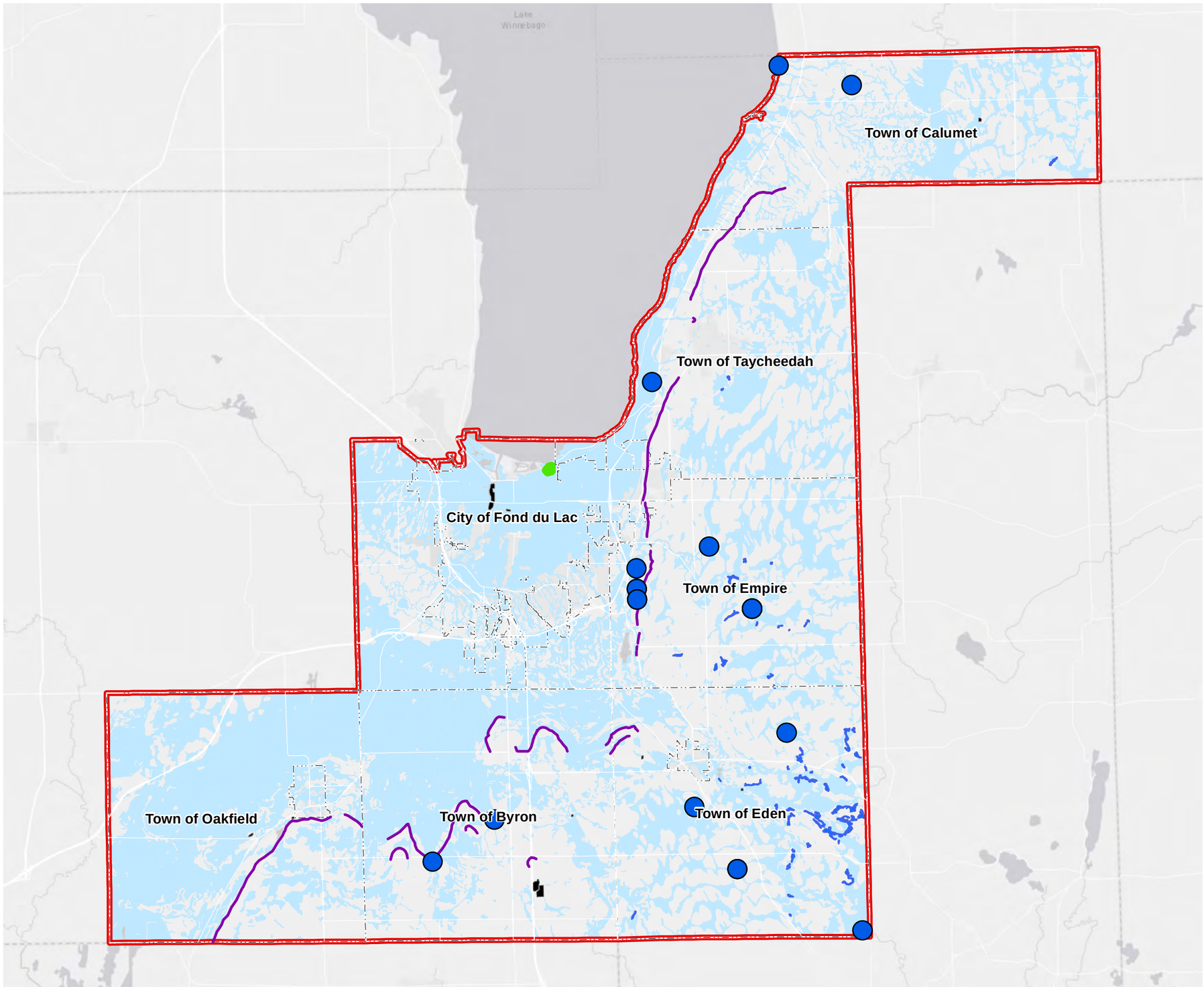
Scale in Miles

PREPARED MAY 2020 BY:

East Central Wisconsin Regional Planning Commission
ECWRPC

D:\ECWGIS\2442_FDLescarpment\Map2-2GlacialGeologyResources.mxd

Map 2-3
Groundwater Resources



- Natural Springs
- Escarpment Outcrops
- Closed Remediation Site
- High Permeability Soil
- Active Landfill
- Inactive Landfill
- Depth to Groundwater < 2 Feet
- MCD Boundary
- Niagara Escarpment Corridor

Source: Data downloaded from Wisconsin DNR GIS Open Portal, NRCS, and WGNHS. Base data from Fond du Lac County.

N
W E
S

0 1 2 4

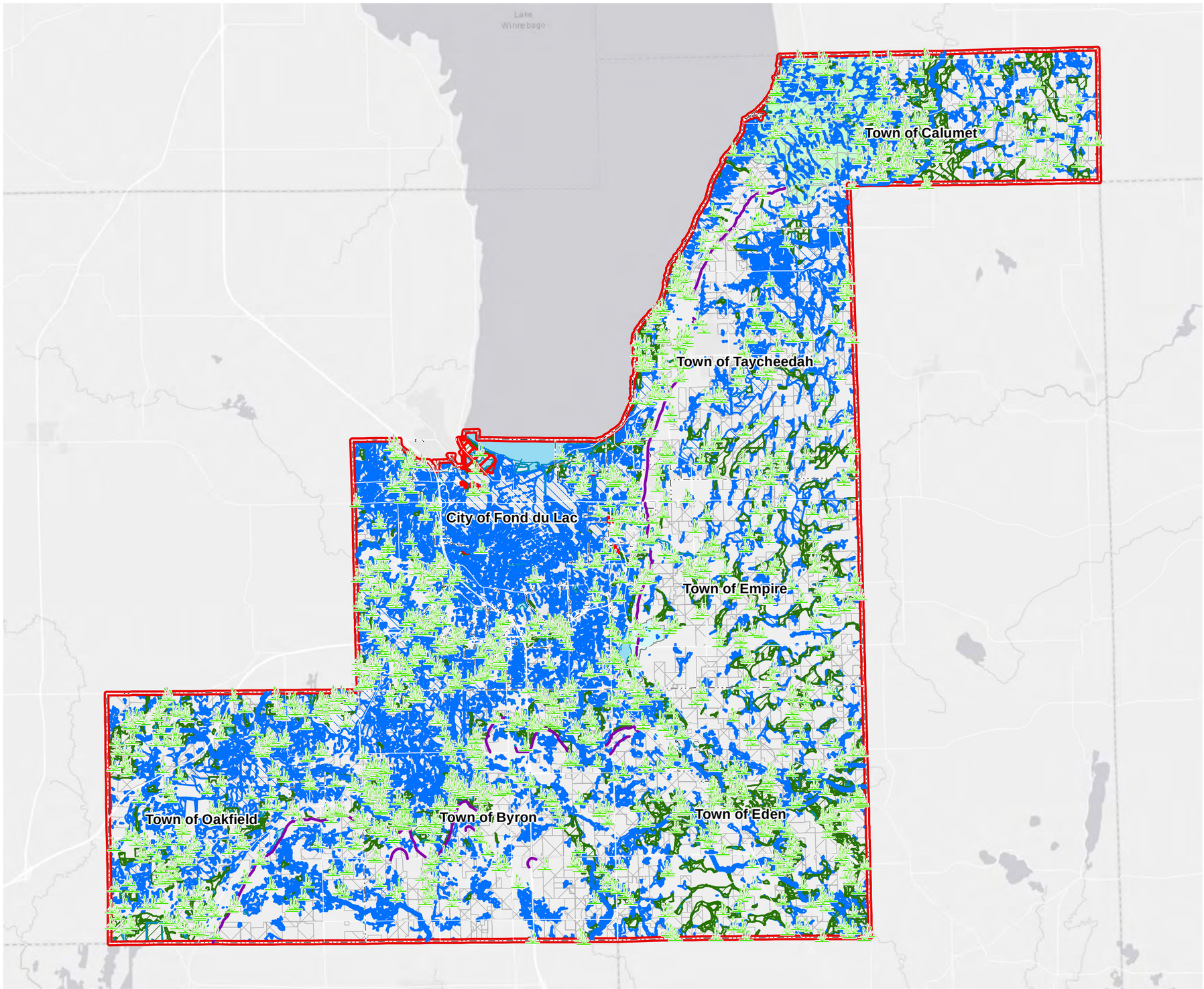
Scale in Miles

PREPARED MAY 2020 BY:

East Central Wisconsin Regional Planning Commission
ECWRPC

D:\ECWGIS\2442_FDLescarpment\Map2-3GroundwaterResources.mxd

Map 2-4
Surface Water Resources



- WDNR Wetlands < 5 Acres
- Escarpment Outcrops
- 303d Categorized Waterways
- Shoreland - Wetlands Zoning
- Water
- 75' Hydro Buffer
- WDNR Wetlands
- Potentially Restorable Wetlands
- Hydro Buffer
- Nutrient Management Parcels
- Pipe Creek Watershed
- Lake Deneveu Watershed
- MCD Boundary
- Niagara Escarpment Corridor

Source: Water, wetland, and watershed data from WDNR Data Portal.
Other base data from Fond du Lac County.

N
W E
S

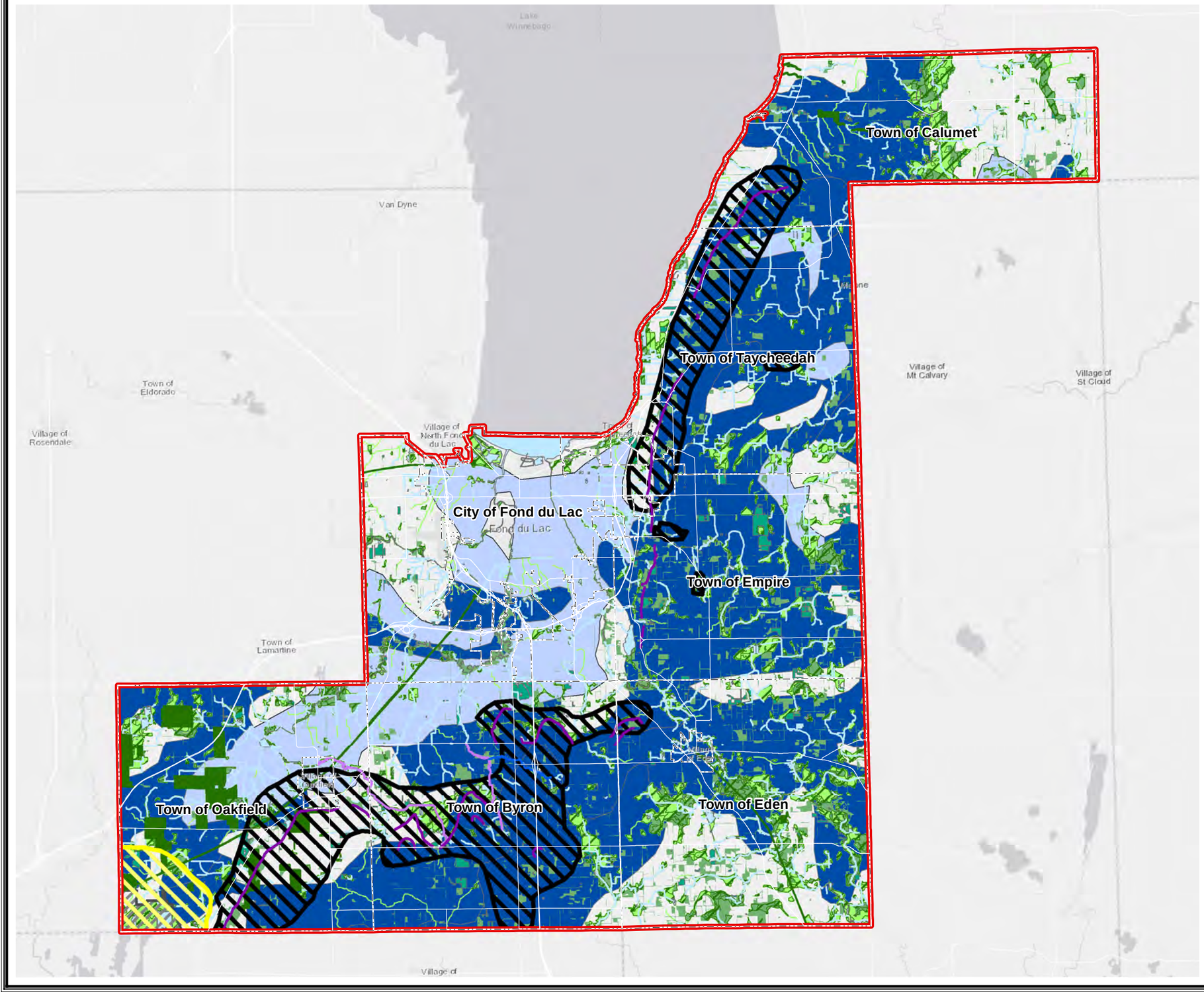
0 1 2 4
Scale in Miles

PREPARED MAY 2020 BY:

East Central Wisconsin Regional Planning Commission
ECWRPC

D:\ECWGIS\2442_FDLescarpment\Map2-4SurfaceWaterResources.mxd

Map 2-5
Ecological Resources



- Escarpment Outcrops
- Class I Trout Stream
- Class II Trout Stream
- Area of Great Concern - Global
- Area of Great Concern - State
- WDNR Managed Land
- Important Birding Areas
- WDNR Wetland
- Planted Woodlots
- Natural Woodlands
- 50' WDNR Wetland Buffer
- 75' Hydro Buffer
- Oak Savanna Areas
- Prairie Areas
- Jack Pine, Scrub (Hill's), Oak Forest and Barrens
- Oak Openings Bur Oak, White Oak, Black Oak
- Prairie
- Swamp Conifers
- White Oak, Black Oak, Bur Oak
- White Pine, Red Pine

Source: Escarpment Outcrop digitized by BLRPC, based on field data by J. Kluessendorf & D. Mikulic, 2000.
Trout Stream, Managed Land, Vegatative Cover, Birding Areas and other data by WIDNR.
Woodlots and Woodlands from ECWRPC Land Use 2015.

N
W E
S

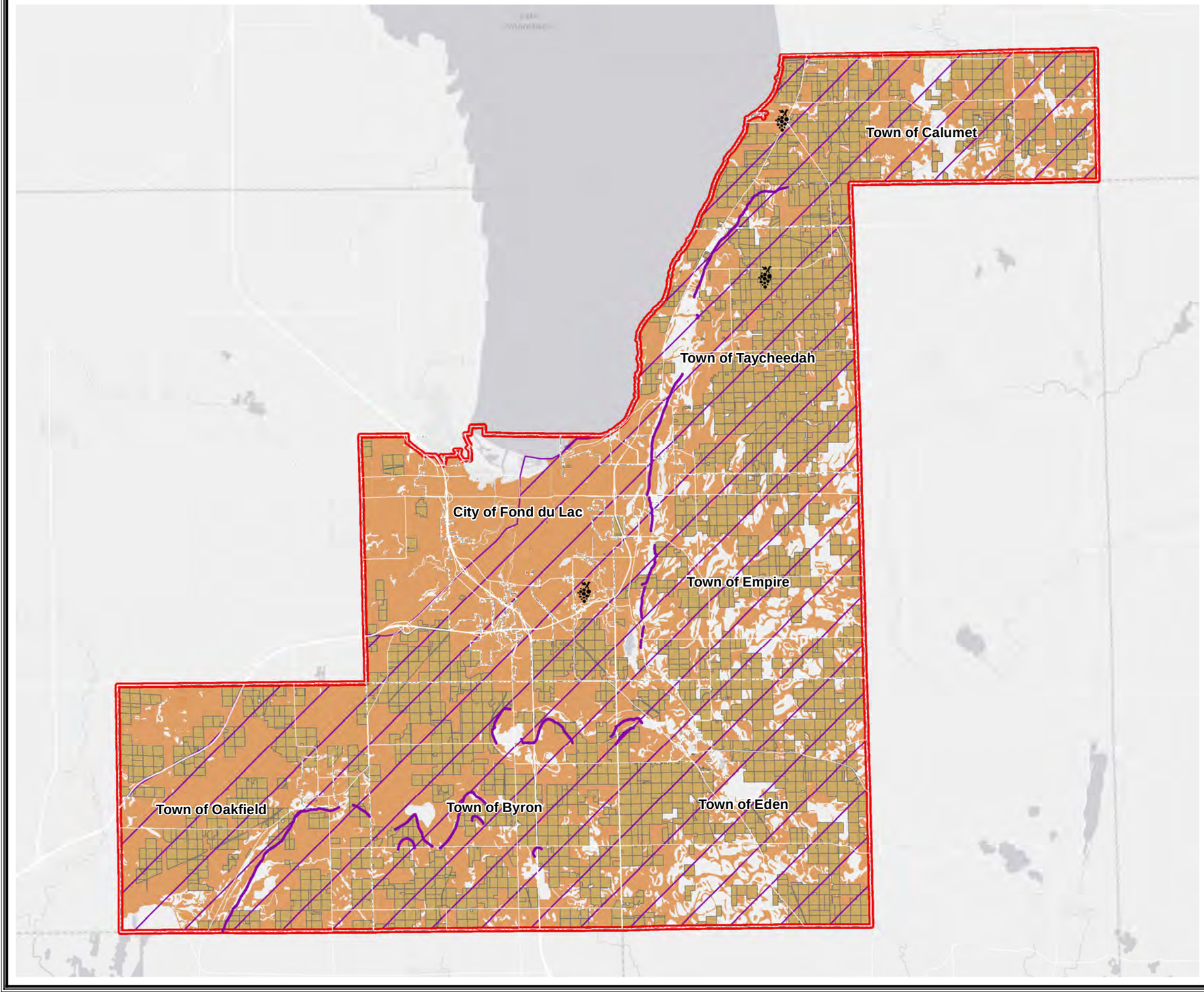
0 1 2 4
Scale in Miles

PREPARED MAY 2020 BY:

East Central Wisconsin Regional Planning Commission
ECWRPC

D:\ECWGIS\2442_FDLescarpment\Map2-5EcologicalResources.mxd

Map 2-6
Agricultural Resources



Other Vineyards

Escarpment Outcrops

Wisconsin Ledge AVA Boundary

Farmland Preservation Program Participants (parcel)

Prime Agriculture Land

MCD Boundary

Niagara Escarpment Corridor

Source: AVA Boundary by ECWRPC, 2009.
WDNR and NRCS for soil data.

N
W E
S

0 1 2 4

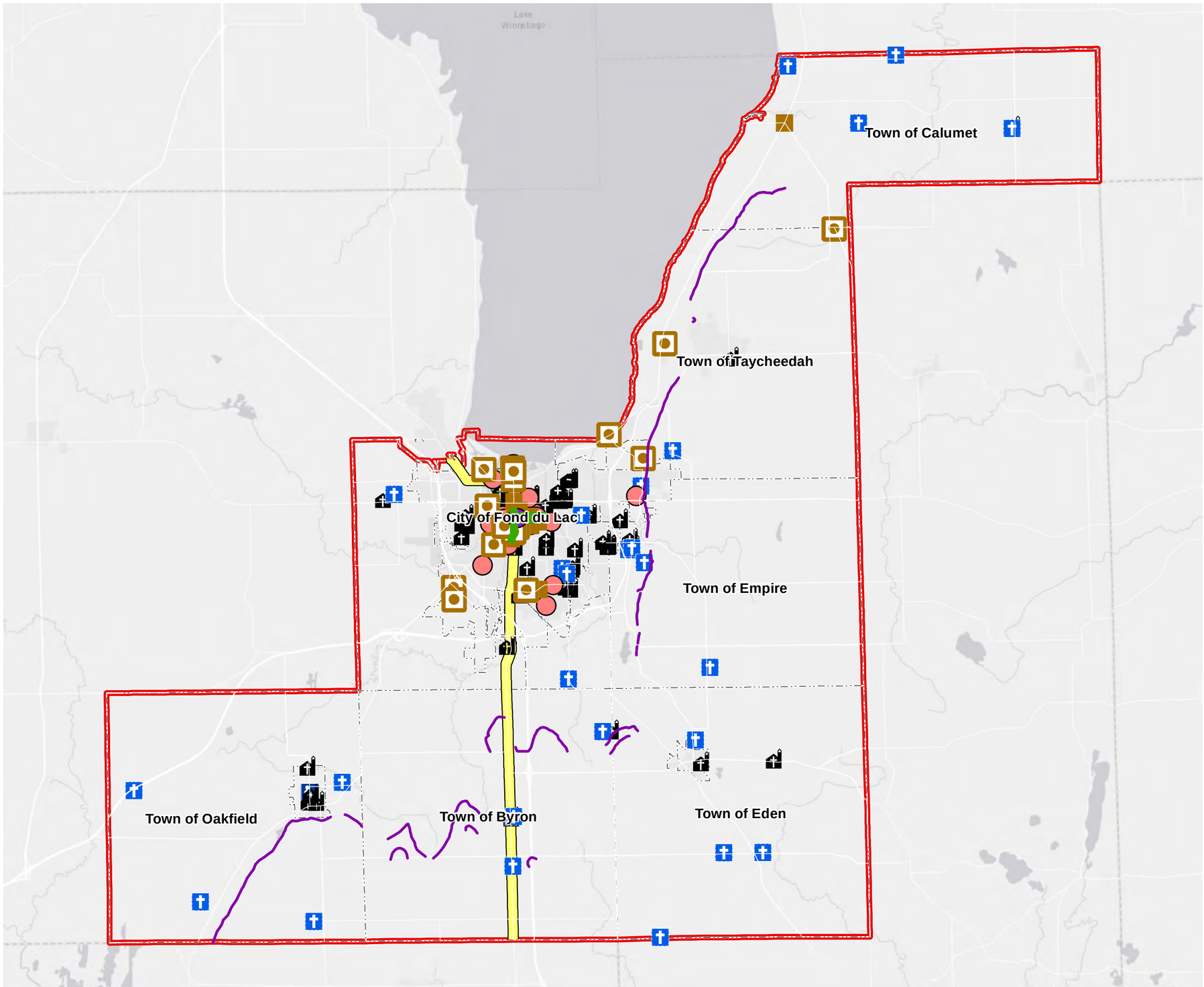
Scale in Miles

PREPARED MAY 2020 BY:

East Central Wisconsin Regional Planning Commission
ECWRPC

D:\ECWGIS\2442_FDLescarpment\Map2-6AgricultureResources.mxd

Map 2-7
Historic & Cultural Resources



- Cemetery
- Church
- Historical Marker
- Historical Site
- Locally Significant Historic Sites
- Library
- Museum
- Performing Arts
- Escarpment Outcrops
- Yellowstone Trail
- Historical Districts
- MCD Boundary
- Niagara Escarpment Corridor

Source: Escarpment Outcrop digitized by BLRPC, based on field data by J. Kluessendorf & D. Mikulic, 2000. Trout Stream, Managed Land, Vegatative Cover, Birding Areas and other data by WDNR.

N
W E
S

0 1 2 4

Scale in Miles

PREPARED MAY 2020 BY:

East Central Wisconsin Regional Planning Commission
ECWRPC

D:\ECWGIS\2442_FDLescarpment\Map2-7HistoricCulturalResources.mxd

CHAPTER 3: GREENWAY ANALYSIS

OVERVIEW

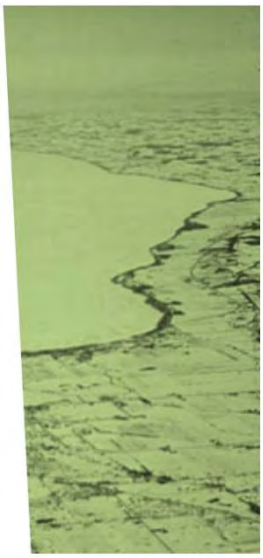
An analysis method was developed using GIS processes to produce a set of detailed, parcel-based, prioritized (ranked) resource maps. The data created from this analysis is used form the basis the proposed Niagara Escarpment Greenway Corridor outlined in Chapter 4. Conceptually, this analysis sheds light on four different aspects of defining the Niagara Escarpment in Fond du Lac County:

1) **Objectively identifying the relative value and function of a parcel's natural and functional resources associated with the Niagara Escarpment.** Done by illustrating (through rankings) which geographic areas or physical features relate or contribute directly or indirectly to the natural and cultural resource base (i.e., "sense of place") of the Niagara Escarpment corridor.

2) **Showing "the best of what's left"** of the (potential) Greenway's individual and collective environmental and cultural resources. This can assist in the development and prioritization of land protection, conservation, and stewardship program activities at the county and local levels.

3) **Providing a broader context for extended linkages** along the Niagara Escarpment corridor and from the Niagara Escarpment to other related natural and cultural sites, thereby creating a broader system (a Greenway) having physical, social, and economic connections across the County.

4) **Finally, the potential costs of conservation can be quantified and estimated,** both in terms of area, level of protection, and even the costs of land protection. This can be done by calculating assessed land valuations for parcels within various priority zones. This information can be used as a basis for further examination of the true values, trade-offs, and investments that come along with conservation and land protection planning and programming efforts.



While the analysis described here is detailed and objective, it is but one of many potential methods by which to analyze the escarpment's resources. As such the reader should make note of the overall qualifications

1) **This analysis is NOT entirely complete**, in terms of additional data sets which could have been integrated into the analysis. Line and point features, for example, could have had buffers applied to include additional rankings based on proximity to these features (trails, historic sites, etc.).

2) **The resource rankings are subjective to some degree**, and those reading this report may feel that some resource rankings should be changed. There are perhaps hundreds if not thousands of variations which could exist in an individual's (or group's) ranking of the individual resources. Each variation, of course, would produce slightly different mapping results. That being said, this set of data and its associated rankings are being provided merely for informational and illustrative purposes. Unless numerous major changes were made to the resource rankings shown in Appendix B, it is unlikely that the overall patterns of parcel prioritization would change greatly from what is shown in this report.

GIS DATA ANALYSIS & RANKING PROCESS

A multi-step process was developed and applied using GIS analysis of many of the resource data layers collected through the inventory process. These steps can generally be described and illustrated as follows:

Step 1: Resource Value Ranking

Using all polygon based layers from the initial inventory, an assessment was done to evaluate and apply a "resource value ranking" using a scale of 1 (low) to 5 (high) based on the author's subjective assessment of the resource's function as it relates its connectedness with the Niagara Escarpment's unique environment.

As an example, the Agriculture Resource Theme had eight distinct "polygon" data sets which were obtained from various sources. A relative ranking of "importance" was given for each data layer as shown in Table 3-1.

Table 3-1: Example of Resource Rankings within Agriculture Theme

GIS Thematic Layers for AGRICULTURE	Ranking Value
Agricultural Enterprise Areas (AEA) (None in Study Area)	3
Current Agricultural Lands Use(Existing Land Use)	4
Agricultural Preservation Zoning	5
Farmland Preservation Program Participants (parcel based)	5
Soils Most Suitable for Grape Production	3
American Viticultural Area (AVA) Boundary	1
NRCS Soils - Prime Agricultural Lands	4
Existing Vineyards / Grape Growing Areas	5

STEP 2: Cumulative Resource Theme Rankings

Once all the rankings were assigned, each of the resource layers within a single Resource Theme were "unioned" with one another. As shown in Figure 3-1, the "union" process simply merges two layers of data to create overlaps (unions) which retain features of the original layers, but also are appended to include the new value of the intersecting layer.

Figure 3-1: GIS Union Process

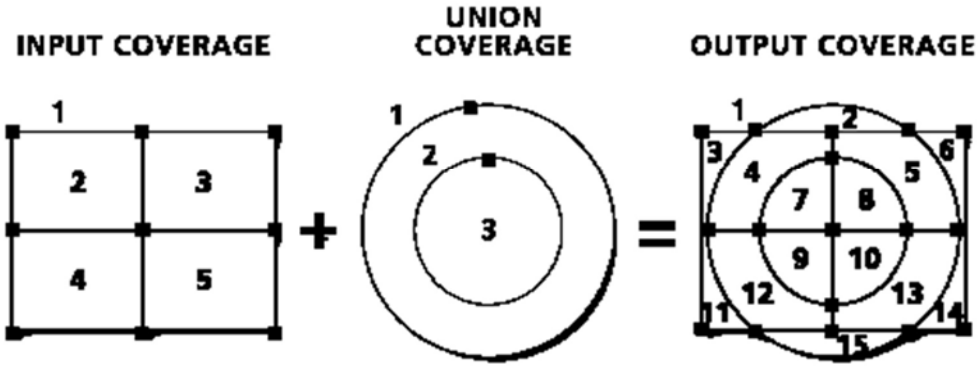


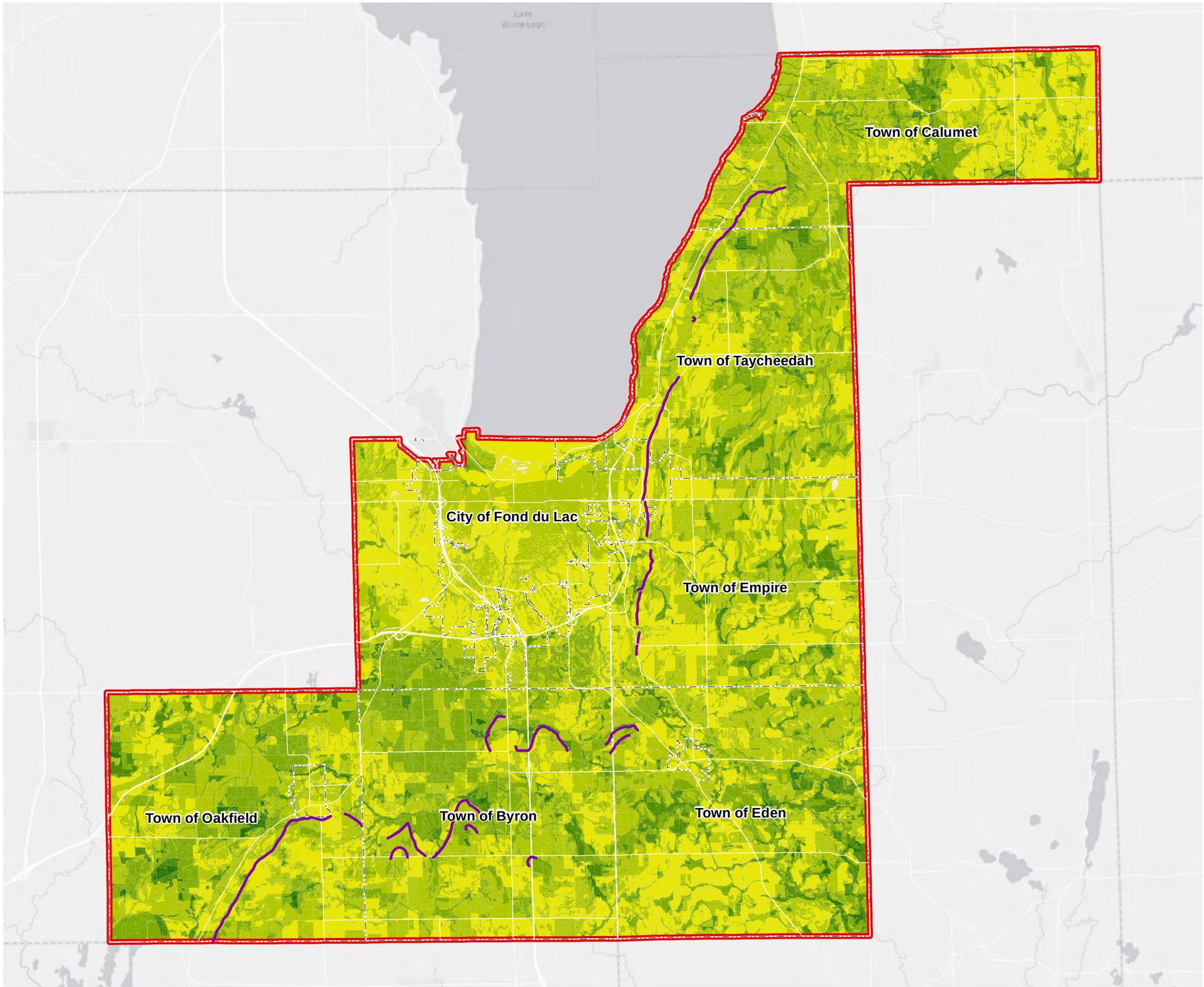
Figure 3-2: Sample of Unioned Data for Agriculture Resource Theme

By applying this process multiple times to all GIS layers within a Resource Theme, a set of new data can be created which illustrates the cumulative (summed) ranking for a specific geographic point. Using the Agriculture Resource Theme's data as an example, a sample of the resulting "unioned" data set based on these rankings, is shown in Figure 3-2.

Appendix C contains a set of six maps (Maps C-1 to C-6) illustrating the "unioned" ranking and prioritization across each of the Resource Themes. Note that historic and cultural information is not included in the assessment as there is limited polygon topology associated with this type of information.

Once the cumulative rankings were created for each Resource Theme, the process was repeated using the results of all six ranked Resource Themes. This created an Aggregate Resource Ranking based on all mapped resource layers within the six Resource Themes (Map 3-1). Ultimately, this produced a data set which contained Aggregate Rankings that in some cases, exceeded 50 points.

Map 3-1
Aggregate Resource Ranking



Escarpment Outcrops

Aggregate Resource Ranking

- Potential Importance (3-15)
- Low Importance (16-23)
- Moderate Importance (24-31)
- High Importance (32-39)
- Extreme Importance (40-54)
- MCD Boundary
- Niagara Escarpment Corridor

Source: Aggregate Resource Ranking is a combination of the six resource layers merged together spatially.

N
W E
S

0 1 2 4

Scale in Miles

PREPARED MAY 2020 BY:

East Central Wisconsin Regional Planning Commission
ECWRPC

D:\ECWGIS\2442_FDLescarpment\Map3-1AggregateResourceRanking.mxd

Step 3: Creation of "Vacant Parcel" Layer

Utilizing 2018 parcels sourced from the State's 2019 Statewide Parcel Map, data was clipped to the Study Area and then was queried for all parcels which had a $0 "improvement value" to create a sub-set of data that reflected only "vacant" (undeveloped) parcels. Road rights-of-way were removed, and a visual scan of the data was done with an air photo background to verify the accuracy of this method. The results for the entire Study Area are shown in Map 3-2 and in a set of more detailed Study Area Tile Maps contained in Appendix C (Maps C-7 to C-18).

Step 4: Ranked Parcel Creation

The Vacant Parcel layer was then "unioned" with each of the ranked Resource Theme data sets to produce a new set of data which illustrates only vacant parcels containing those sets of resources, along with their associated ranking values. An example is shown in Figure 3-3 and a set of six parcel maps for each Resource Theme are contained in Appendix C (Maps C-19 to C-24).

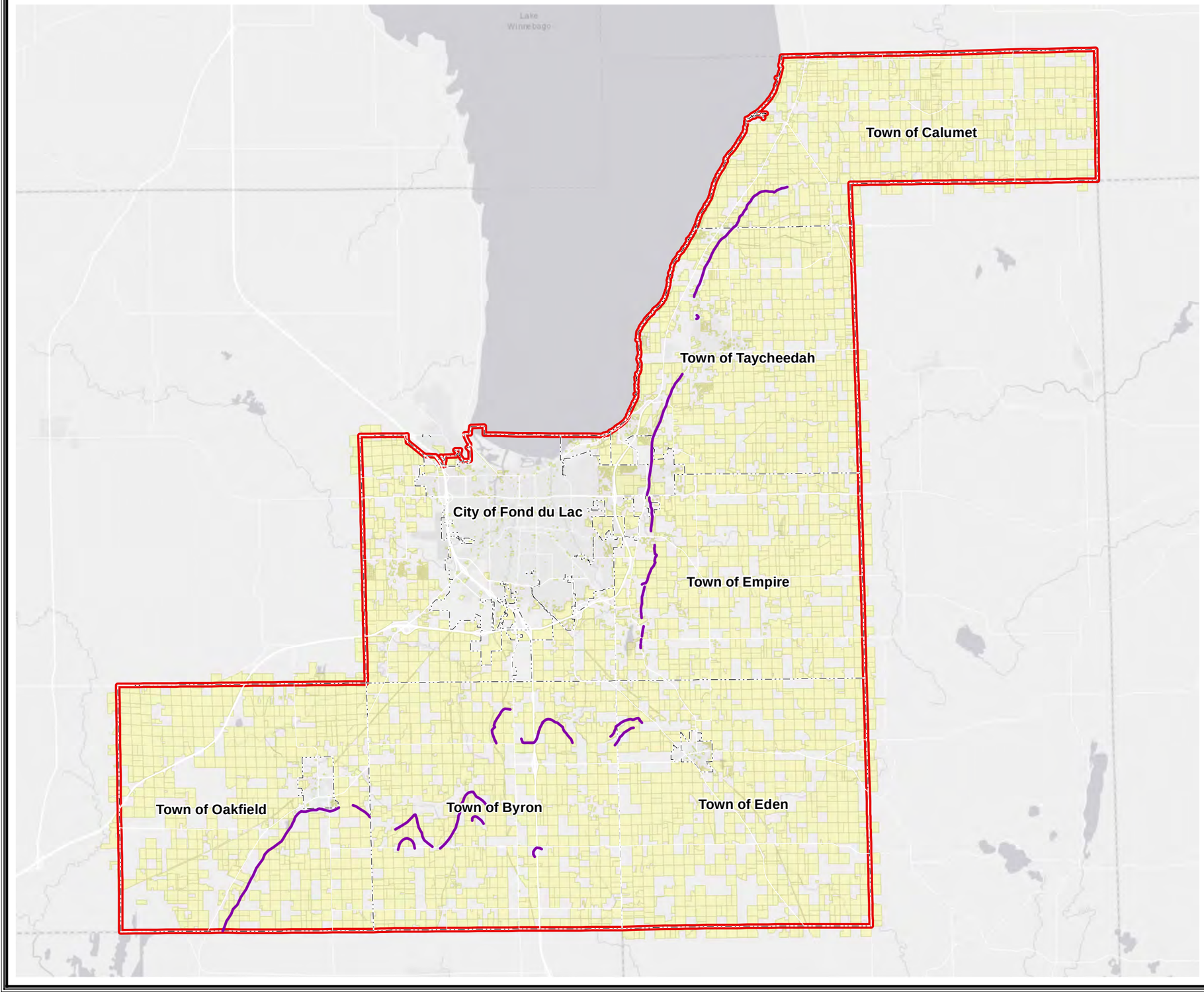
Figure 3-3: Sample of Ranked Vacant Parcels for Glacial Geology Resource Theme

Ultimately, all the ranked Resource Theme coverages (Step 2) were unioned with the vacant parcel information to produce a new coverage which contains a single ranking value for each parcel (Vacant Parcel Aggregate Resource Ranking). Where a parcel contained multiple values, the dominant value (by area) was assigned. The final rankings were placed in to five categories for mapping purposes as follows:

- Potential Importance (3-15 pts)
- Low Importance (16-23 pts.)
- Moderate Importance (24-31 pts.)
- High Importance (32-39 pts.)
- Extreme Importance (40-54 pts.)

Map 3-3 illustrates the Vacant Parcel Aggregate Resource Ranking for the entire Study Area while set of detailed Tile Maps are in Appendix C (Maps C-25 to C-36).

Map 3-2
Vacant Parcels
(Zero Improved Value)



- Escarpment Outcrops
- Parcels with Zero Improved Value
- MCD Boundary
- Niagara Escarpment Corridor

Source: Parcels (Zero Improved Value) from 2019 (2018 data) state-wide parcel map, WI State Cartography Office.

N
W E
S

0 1 2 4

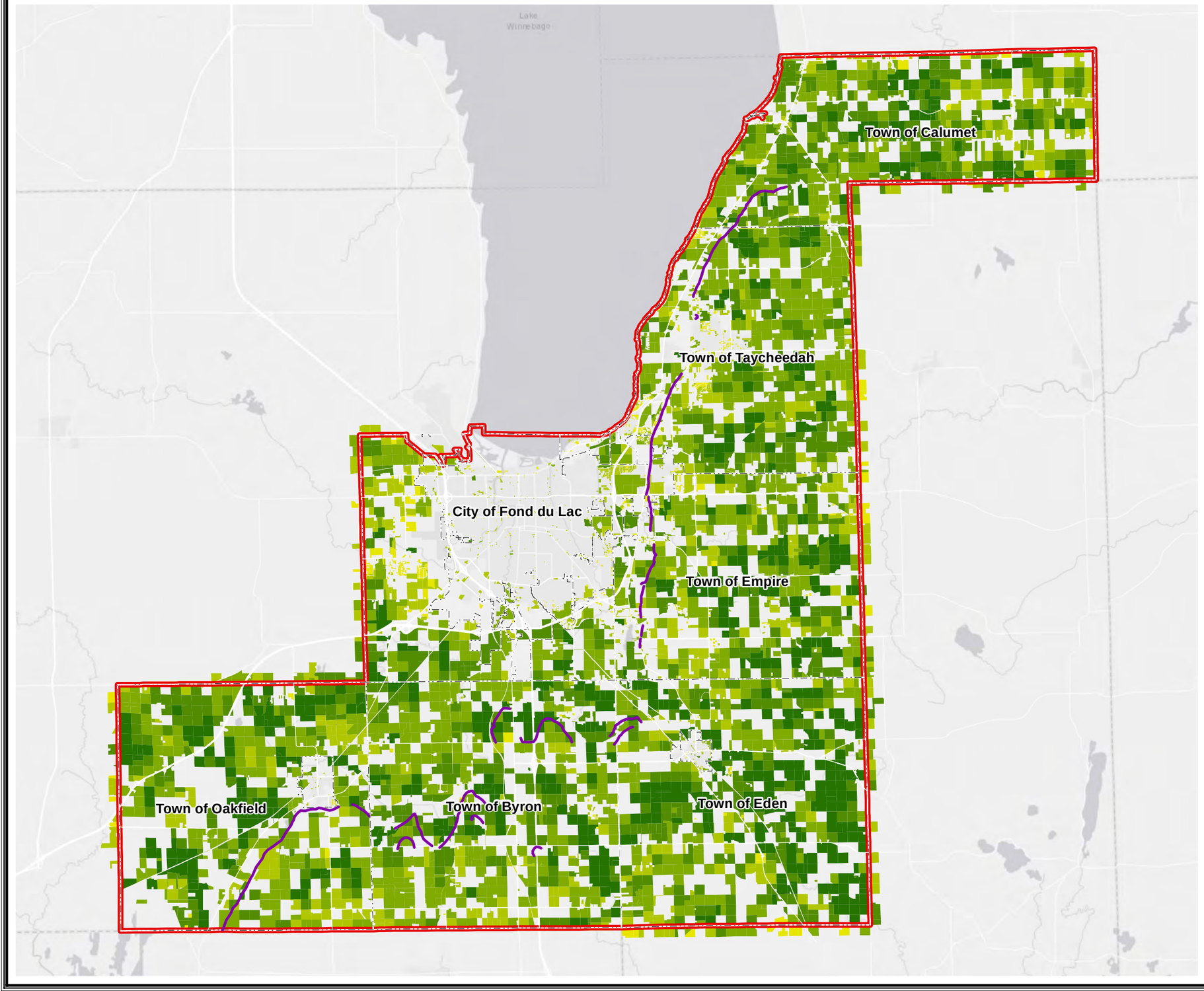
Scale in Miles

PREPARED MAY 2020 BY:

East Central Wisconsin Regional Planning Commission
ECWRPC

D:\ECWGIS\2442_FDLescarpment\Map3-2VacantParcels.mxd

Map 3-3
Vacant Parcels
Aggregate Resource Ranking



Escarpment Outcrops

Aggregate Resource Ranking

- Potential Importance (3-15)
- Low Importance (16-23)
- Moderate Importance (24-31)
- High Importance (32-39)
- Extreme Importance (40-54)
- MCD Boundary
- Niagara Escarpment Corridor

Source: Vacant Parcels assigned highest value from Aggregate Resource Ranking layer intersection.

N
W E
S

0 1 2 4

Scale in Miles

PREPARED MAY 2020 BY:

East Central Wisconsin Regional Planning Commission
ECWRPC

D:\ECWGIS\2442_FDLescarpment\Map3-3VacantParcelsAggregateResourceRanking.mxd

Step 5: Creation of Escarpment Buffer Zones

Using the Niagara Escarpment cliff face feature, three buffer layers were created that consider how a user of the Greenway might interact or move about its corridor. Lifestyles, recreation, tourism, and mobility were considered conceptually when creating these buffers:

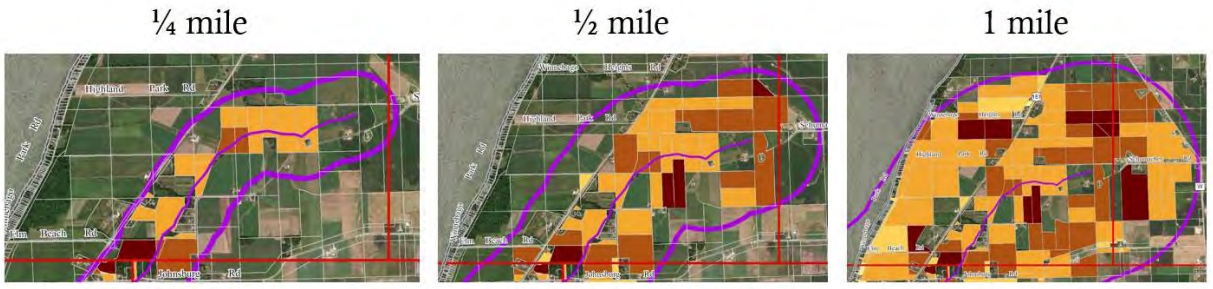
- One-quarter mile, or 1,320' (~400m). In an urban or suburban setting, this distance is typically considered "walkable" for conducting daily tasks (transit, work, errands) or about the distance covered in 5 minutes. In this case, the corridor is one-quarter mile on either side of the escarpment, hence the total width is one-half mile. About a 10-minute walking distance from one side to the other.

- One-half mile, or 2,640' (~800m). Individuals who walk for exercise or recreation are bound to exceed the distances above. Increasing the buffer to one-half mile (or 10-minute walk) creates a corridor that is one-mile wide (20-minute walk) and most certainly provides more opportunities to create "hikeable" experiences.

- One-mile, or 5,280' (~1,600m). This distance represents about a 6-minute casual bicycle ride (while a professional rider might cover it in 2-minutes), and therefore is highly "bikeable" as a corridor. A one-mile buffer creates a corridor 2-miles in width, or about a 12-minute bike ride (plus or minus time based on terrain conditions).

Figure 3-4 illustrates an example of these buffer zones and the ranked parcels that lie wholly within them. A series of 36 more detailed tiled maps (12 for each buffer) are contained in Appendix C (Maps C-37 to C-72).

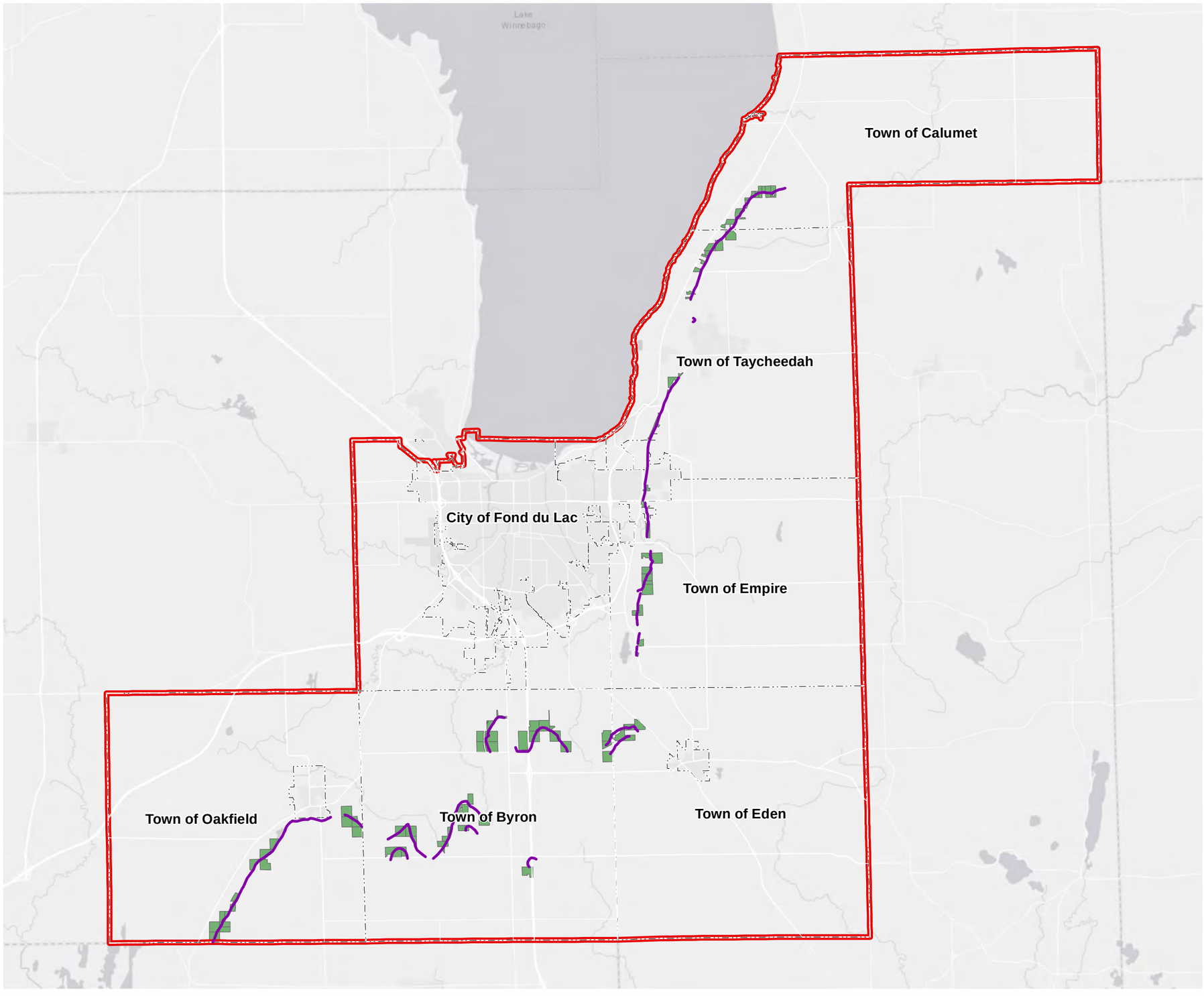
Figure 3-4: Example of Escarpment Buffer Zones & Aggregate Ranked Parcels



Step 6: Niagara Escarpment Parcels

The last data preparation and analysis step consists of identifying all vacant parcels which intersect with the Niagara Escarpment cliff face. The reselected set of parcel data is shown in Map 3-4 and consists of 128 parcels of land totaling 2,208 acres. A set of detailed Study Area Tile Maps are contained in Appendix C (Maps C-73 to C-84)

Map 3-4
Niagara Escarpment Parcels



Escarpment Outcrops

Vacant Parcels Intersecting Escarpment Outcrops

MCD Boundary

Niagara Escarpment Corridor

Source: Vacant Parcels intersecting the Niagara Escarpment Outcrops.

N
W E
S

0 1 2 4

Scale in Miles

PREPARED MAY 2020 BY:

East Central Wisconsin Regional Planning Commission
ECWRPC

D:\ECWGIS\2442_FDLescarpment\Map3-4NiagaraEscarpmentParcels.mxd

CHAPTER 4: A GREENWAY PLAN & STRATEGY

OVERVIEW

This chapter outlines a proposed concept plan for a Niagara Escarpment Greenway in Fond du Lac County as well as specific strategies and recommendations that the County may want to consider to further define and implement conservation activities. Based on the three major components of the Greenway Analysis contained in Chapter 3 (resource rankings, Niagara Escarpment buffers, and Niagara Escarpment parcels), greenway concept maps and a set of definitions were prepared in order to help the County focus on land areas which may have the most impact in terms of conservation and protection.

DEFINITIONS

To better establish priorities for escarpment conservation within the County, it is useful to review and understand two of the key terms utilized in this Study – "Niagara Escarpment" and "Greenway".

Niagara Escarpment

The Niagara escarpment is quite narrowly defined in most geologic publications. As noted in the *Geography of Wisconsin & Upper Michigan* (Paul, 1977), an escarpment is "*a long, continuous cliff or relatively steep slope facing in one general direction. It commonly marks the position of a resistant rock unit*". In 2000, geologists Joanne Kluessendorf and Donald Mikulic crafted their definition for the Niagara Escarpment as follows: "*A discontinuous bedrock-controlled, geomorphologic feature composed of any and all outcrops that form a rock ridge or series of ridges at the bedrock surface along the 'western' edge of the Silurian ('Niagaran') outcrop belt*." These definitions basically define the escarpment as something that is perhaps several to tens of feet wide perhaps.

Some local ordinances have been adopted along the escarpment corridor that acknowledge the narrow "cliff" definition but have expanded it to also include other elements:

- "*A steep slope, or series of cliffs or steep slopes, which faces in one general direction, breaks the continuity of the land by separating two comparatively level or more gently sloping surfaces, and is produced by erosion or by faulting*." - Door County Zoning Ordinance.

- "*Defined as a slope of 90 degrees or visual exposure of rock outcropping(s) on the horizontal surface*." - T. Taycheedah, 2000.

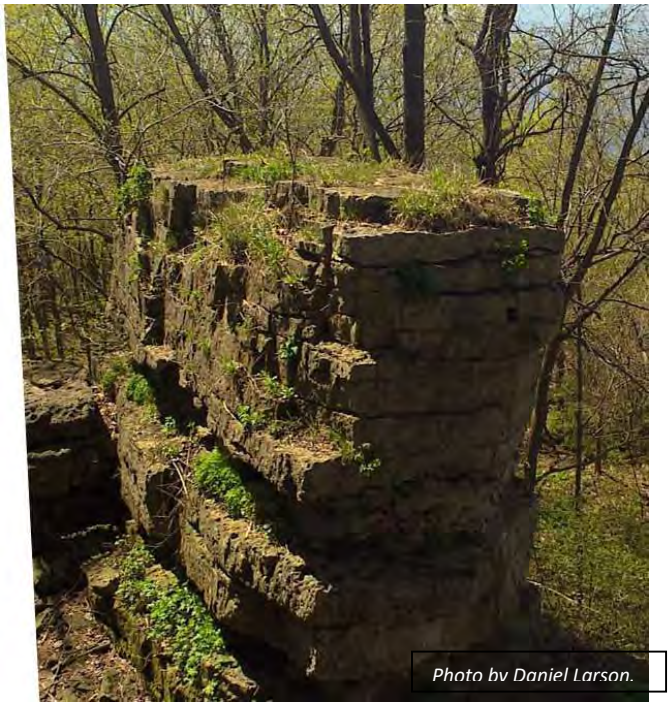


Photo by Daniel Larson.

These definitions might expand the width of the Niagara Escarpment to perhaps a few hundred feet when incorporating these other features of the landscape. Some communities, however, have thought even more broadly about how they define the escarpment and taking into consideration aspects other than geology, such as habitat and scenic values. The Town of Oakfield generally uses 300 feet on either side of the cliff face (600-foot total width) to aid in land use decisions, but also acknowledges the potential for negative impacts up to a mile away. The Town of Empire uses the same 300-foot escarpment buffer but also established a broader Critical Area Overlay district adjacent to it, in some cases nearly a mile from the cliff face, which regulates development activity.

Unfortunately, there is no "magic number" for a consistent distance from the escarpment's cliff face that would encompass every important resource that is connected to it or that influences its character. Recommendations on how to define the Niagara Escarpment in Fond du Lac County are provided later in this chapter.

Greenway

The term greenway comes from the 'green' in greenbelt, emphasizing the introduction or maintenance of vegetation) and the 'way' in parkway (implying a recreational or pedestrian component), The American author Charles Little in his 1990 book, Greenways for America, defines a greenway as:

> *"A linear open space established along either a natural corridor, such as a riverfront, stream valley or ridgeline, or overland along a railroad right-of-way converted to recreational use, a canal, scenic road or other route. It is a natural or landscaped course for pedestrian or bicycle passage; an open-space connector linking parks, nature reserves, cultural features, or historic sites with each other and with populated areas."*

Greenways and green spaces are significant for several reasons, including:

1) Maintaining environmental and ecological quality (water quality, air quality, habitat, and wildlife)

2) Providing local and regional economic benefits (agriculture, forestry, tourism, and talent attraction), and;

3) They can increase aesthetic values, livability, and quality of life. (recreation, history/culture, nature study, healthy lifestyles)

The Niagara Escarpment in Fond du Lac County is a perfect example of a large scale natural corridor that could be designated, planned for, and protected at some level to offer an amenity like no other for residents and visitors alike.

PROPOSED NIAGARA ESCARPMENT GREENWAY

Using the main data outputs from Chapter 3, Greenway Analysis, a proposed *Fond du Lac County Niagara Escarpment Greenway* was developed by combining some of its various analysis elements. By doing so, an objective visual of the "most important" areas for escarpment conservation can be identified within the County. Furthermore, the Greenway map helps to identify opportunities to connect these lands with additional greenspace, habitat, or trails.

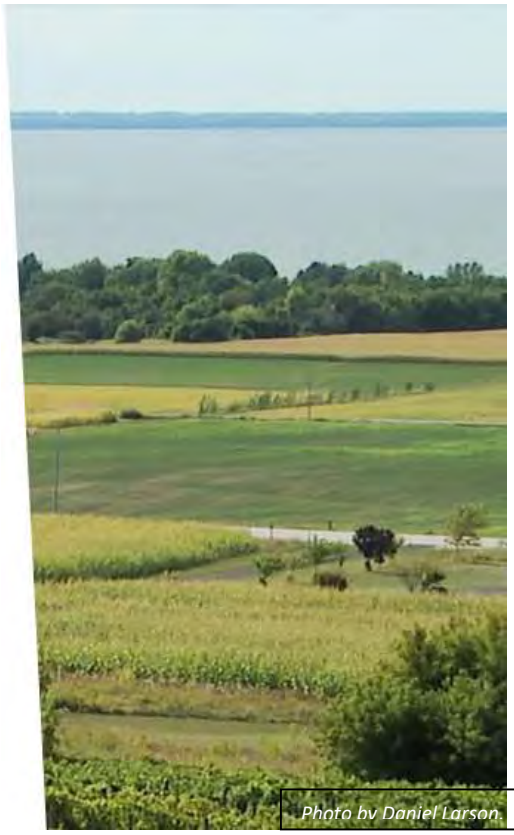


Photo by Daniel Larson.

The Greenway map was produced by combining four of the basic data elements created during the analysis:

1. Aggregate Vacant Parcel Resource Rankings (parcel rankings);

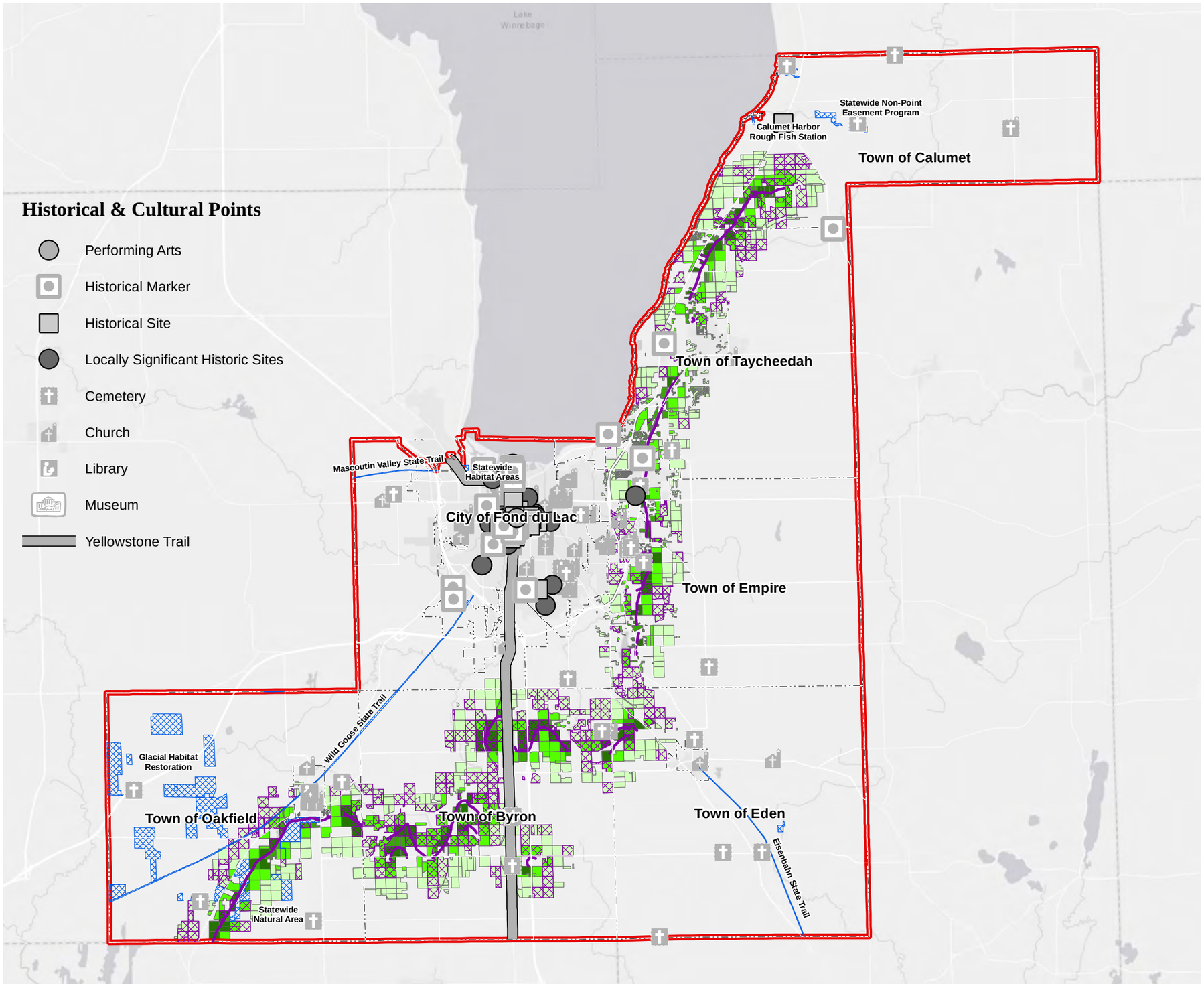
2. Niagara Escarpment Buffer Zones (¼ mi., ½ mi., and 1 mi.);

3. Niagara Escarpment Vacant Parcels, and;

4. Publicly Owned Lands

Map 4-1 illustrates the proposed Greenway along with detailed maps (C-85 to C-96) in Appendix C.

Map 4-1
Proposed Niagara Escarpment Greenway Elements



Historical & Cultural Points

- Performing Arts
- Historical Marker
- Historical Site
- Locally Significant Historic Sites
- Cemetery
- Church
- Library
- Museum
- Yellowstone Trail

- Escarpment Outcrops
- WDNR Managed Land
- Vacant Parcel with Aggregate Ranking 32 or Higher
- MCD Boundary
- Niagara Escarpment Corridor
- Vacant Parcels Intersecting Escarpment Outcrops
- Vacant Parcels - 1/4 Mile Buffer
- Vacant Parcels - 1/2 Mile Buffer
- Vacant Parcels - One Mile Buffer

Source: Parcels from State-wide parcel data set (2018).
Buffers were created by ECWRPC.
Historical & Cultural elements are approximate in location.

N
W E
S

0 1 2 4
Scale in Miles

PREPARED MAY 2020 BY:

East Central Wisconsin Regional Planning Commission
ECWRPC

D:\ECWGIS\2442_FDLescarpment\Map4-1ProposedNiagaraEscarpmentGreenwayElements.mxd

Greenway Elements & Description

The basis for the Greenway is first established by identifying all vacant parcels of land that lie within 1 mile of the escarpment face. The escarpment cliff face itself (purple line) was defined by using data created by J. Kluessendorf and D. Mikulic with the addition of linework for the Town of Empire based on information contained in its comprehensive plan.

Next, a series of green shades were applied to vacant parcels based on their distance from the escarpment cliff face. These are grouped into four distance categories:

1. Parcels intersecting with the escarpment (darkest green)
2. Whole parcels within ¼ mile of the escarpment
3. Whole parcels between ¼ and ½ mile of the escarpment, and
4. Whole parcels between ½ mile and 1 mile of the escarpment (lightest green)

Utilizing the buffers, a base level of "importance" can be established given a vacant parcel's proximity to the escarpment cliff face. The closer the parcel is to the cliff face, the "more important" it becomes in terms of its sensitivity to the escarpment ecosystem.

In addition to the proximity ranking, the aggregate resource rankings were then applied as a hatched (purple) overlay to clearly illustrate those vacant parcels which had relatively "high" or "extreme" importance based on values assigned to them. All vacant parcels with an aggregate ranking of 32 or more were reselected from within the overall set of parcels which ranged from a low of 3 points to a high of 54 points.

Lastly, the Greenway includes all publicly owned lands (local parks, state wildlife areas, known easements, etc.) as they are already protected or conserved to a certain degree. In addition, these blue hatched areas help to fill in gaps between clusters of "important" parcels.

Finally, known cultural and historic sites were added to the Greenway map so that they can be integrated and connected to other Greenway resources.

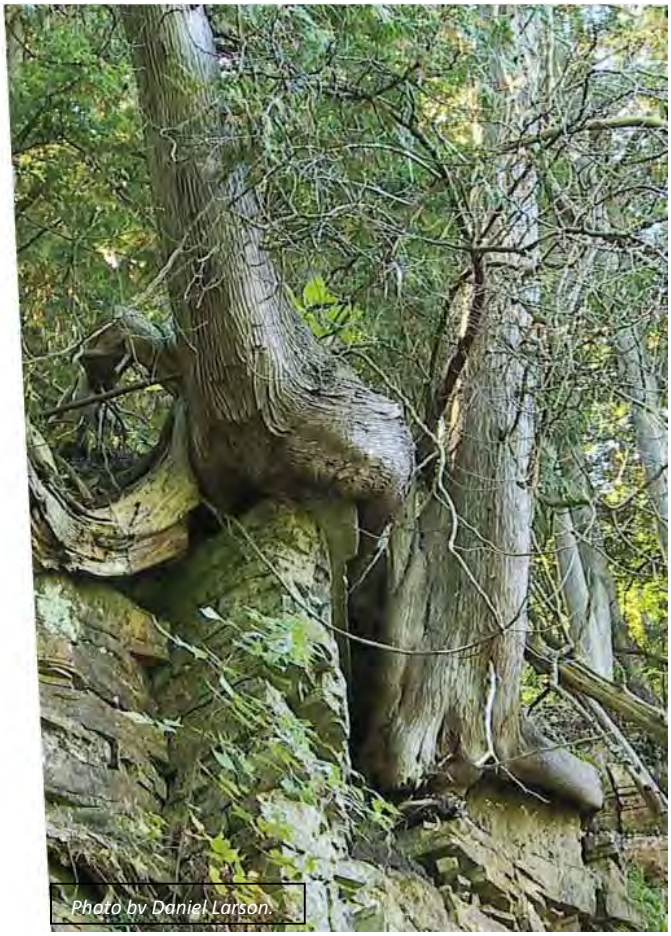


Photo by Daniel Larson.

RECOMMENDED NIAGARA ESCARPMENT DEFINITIONS

It is generally recognized that land use changes and activities which occur near to, as well some distance from, the actual face of the Niagara Escarpment can negatively impact its fragile ecosystem as well as its broader aesthetic qualities. Talus slopes below the escarpment face are of equal importance, as are the areas of karst and high bedrock located well behind its brow.

For the purposes of the Fond du Lac County Niagara Escarpment Greenway Plan, defining the Niagara Escarpment takes this broad approach to emphasize that not just those lands in closest proximity to a cliff face are of importance to the environment and/or community. Three definitions are recommended so that moving forward, consistency in terminology and the expression of ideas can be achieved:

Niagara Escarpment: A long, discontinuous, bedrock-controlled cliff or relatively steep slope facing in one general direction. Composed of any and all outcrops, including horizontal exposures at the surface, which form a rock ridge, or series of ridges, along the 'western' edge of the Silurian ('Niagaran') outcrop belt. This includes areas of steep slope (12% or more) that have no rock outcrops that lie between two rock exposures. The escarpment location is mapped based on the best available data but is always subject to field determinations and verification.

Niagara Escarpment Corridor: All parcels of land generally lying within ¼ mile of the defined Niagara Escarpment cliff face.

Niagara Escarpment Greenway: All parcels of land generally lying within 1 mile of the Niagara Escarpment cliff face.

STRATEGIES & RECOMMENDATIONS

The information presented in this report provides one of the most objective views yet of the Niagara Escarpment's landscape in terms of ecological value. While the Greenway Study is considered to be advisory in nature, it contains a wealth of information that could assist the County and its communities in conservation and land use planning within the corridor. As such, several strategies and recommendations have been developed for how the County can make best use of this information and how to generate continued discussion and refinement of the Greenway concept:

1. Conduct a secondary analysis on the vulnerability of priority vacant parcels within the Greenway based on an examination of local zoning. This simple GIS exercise will add yet another layer of insight as to which parcels of land should be focused on for conservation as they may be the at the most risk for development activity.

2. Review Greenway parcel maps closely to ensure accuracy of information and to suggest modifications or corrections.

3. County staff should review the Greenway parcel maps to identify specific areas of opportunity. For example, clusters of high-ranking parcels, parcels adjacent to public lands, etc.

4. Create an on-line mapping tool to display the Greenway parcel information so that county and municipal leaders and staff, as well as the general public have access to the information.

5. In concert with the communities in the Study Area, consider the development of a PDR and/or a TDR program applying to the Greenway.

6. Consider how the Greenway Plan can be “formalized”, perhaps as part of the County’s Smart Growth Comprehensive Plan as well as integration into local communities’ comprehensive plans.

7. Create a formalized ad hoc Planning Committee at the County level, with representatives from the Study Area communities, that is focused on furthering the Niagara Escarpment Greenway concept.

8. The Greenway should be integrated into updates of existing county and community Open Space & Recreation Plans. Additional analyses and public opinions could be obtained to help identify new trail linkages along or across the Greenway.

9. The County should work with Study Area communities to encourage a consistent set of standards, ordinances, and other land use regulations within the Greenway. This could include zoning, land division, conservation subdivision, stormwater management, tree cutting, invasive/noxious weeds.

10. Support and become involved in ongoing efforts by the Niagara Escarpment Resource Network to build/launch a formalized geotourism program. Heritage, ecology and recreation efforts can be intertwined to assist in the improvement of local and regional economies and can also be used a mechanism to better inform, educate, and build awareness on the ecological and conservation needs of the Niagara Escarpment as a system.

11. Promote and 'brand' the Greenway through the development of local and regional driving tours, or designated scenic routes, which focus on the varied sites and scenic resources of the Niagara Escarpment. Perhaps some common signage to designate the routes could be installed to guide travelers.

12. Promote existing financial incentive programs for setting private lands aside for wildlife purposes such as the Conservation Reserve Program (CRP) or Wetland Reserve Program.

13. Consider how the County might Increase cost-sharing to agricultural lands for improved conservation practices that are near sensitive land parcels within the Greenway.

14. Partner with local universities to foster and support additional environmental research and study within the Greenway.